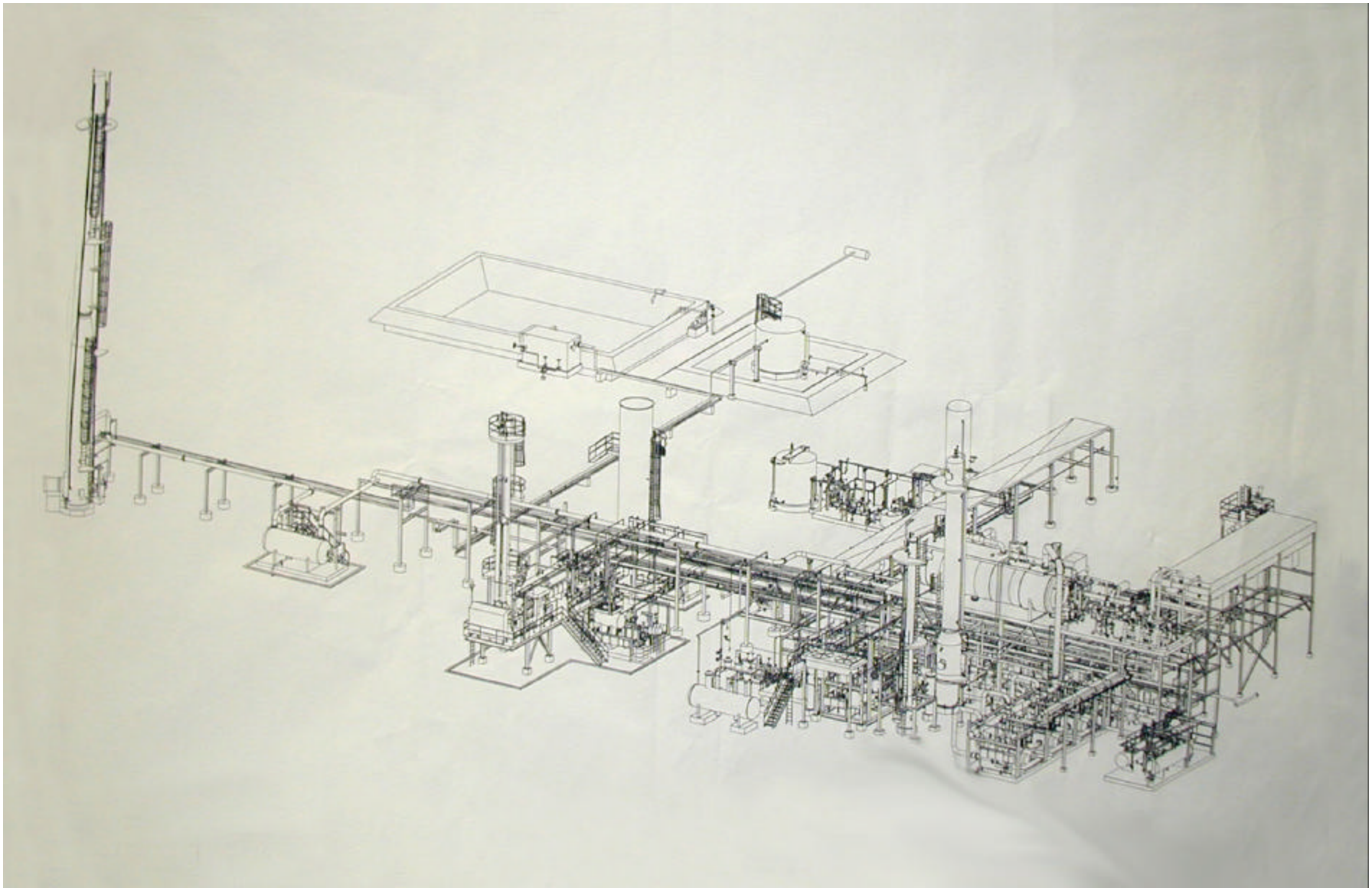
Attachments to SPR 2005 DOE Pollution Prevention Award Application

1. Isometric Drawing of Standard Modular Degasification Plant Layout for Application to Each SPR Facility



2. Photographs of Completed Modular Degasification Plant at the Big Hill Facility, and Assembly of Some of the Modular Components

3. Added Business Value Based on Projected Cost Savings and Cost Avoidances:

DESCRIPTION OF COST SAVINGS (CS) OR COST AVOIDANCE (CA)	CLASSIFICATION (AS CS OR CA)	$MILLION	CALCULATION
Value of Emissions retained as product:	CA	21	77,000 tons x 6.8 bbl/ton x $40/bbl = $20,944,000
Value of Equivalent ERCs, if Purchased or Sold	CA	108	At $1,400/ton x 77,000 tons = $107,800,000 At $11,000/ton x 77,000 tons = $847,000,000
Savings to Operate a Single Plant over 25-year Lifecycle	CS	53	$126,414,107 (for 2 plants) - $73,721,651 (for 1 plant) = $52,692,456
Cost to Dispose Waste H_2S	CA	2	$2.90/lb x 2,000 lbs/ton x 283 tons = $1,641,400
Propane Fuel Reduction due to Vacuum Degasification[1]	CA	3	11 caverns x 253,000 gal/cavern x $1.15/gal[2] = $3,200,450
Cost of H_2S Scavenger	CA	31	Current budget estimate for 2 months of drawdown today[3]
TOTAL ($MILLION)		**218**	

NOTES:

1. Estimate that gas removed from the 11 lean caverns would require 253,000 gallons of supplemental propane each to achieve sufficient heat value in order to drive thermo-degasification. This assumes gas from the other caverns processed would be self-sustaining. Vacuum degasification eliminates this fuel need.
2. Estimate propane to cost $1.00 to $1.30/gallon, or an average of $1.15/gallon.
3. The current drawdown budget assumes $31,000,000 for H_2S scavenger; however, the amount of scavenger needed will increase proportionally as the oil becomes more gassy over time, making this a conservative estimate for the 25 year lifecycle period.

4. Life Cycle Costs Projected for Managing SPR Vapor Pressure using Single Plant and Two Plant Options:

The following attachments are lifecycle cost estimates for constructing, operating, and maintaining two degasification plants in parallel vs. operation of a single degasification plant at the SPR facilities in series.

Under the two-plant option two entirely independent plants would be deployed to two sites and be operated simultaneously. Once degasification is completed at a facility, that plant could be disassembled and re-deployed to another facility. In this manner all SPR facilities are degassed and maintained degassed with estimated 25-year lifecycle costs of $126,414,107.

Under the one plant option a single degassing plant made up of modular readily transportable units is deployed initially at the Big Hill Facility where the most urgent need for degasification exists. When work at Big Hill is completed, the plant is broken down by module and transported to the next facility where it is reassembled and operated as necessary. This approach continues through the 25 year lifecycle rotating from facility to facility (including return visits to facilities) as appropriate to support the SPR mission. The single-plant modular design facilitates ease of assembly and disassembly, reducing down time, and provides a standard operating environment across facilities for the degas operations crew. In this manner all SPR facilities are degassed and maintained degassed with estimated lifecycle costs of $73,721,651.

The 25-year lifecycle difference in costs between the two approaches is $52,692,456. The lifecycle cost estimate planning sheets used to compare these options on a 25 year lifecycle basis are the following two attachments.

LIFE CYCLE COST

TITLE: Vapor Pressure Mitigation Plant - Degas 2 (Two Plants)

CONTRACTOR CHANGE NO./REV.	ECP NUMBER
01031507 R1	VA-M/O-8321 R1

Two Plant scenario:

PRESENT VALUE = $ 126,414,107
ESCALATION RATE = 2.1%
DISCOUNT RATE = 4.1%

n = YEAR	PROPOSED CAPITAL EXPEND.	PROPOSED MAINT. EXPEND.	PROPOSED TOTAL EXPEND.	ESCALATION FACTOR	ESCALATED COST	DISCOUNT RATE	PRESENT VALUE
1	$ 37,385,000	$ -	$37,385,000	1.0000	$ 37,385,000	1.0000	$ 37,385,000
2		$ -	$ -	1.0210	$ -	0.9606	$ -
3		$4,685,600	$ 4,685,600	1.0424	$ 4,884,462	0.9228	$ 4,507,287
4		$4,685,600	$ 4,685,600	1.0643	$ 4,987,035	0.8864	$ 4,420,692
5		$4,685,600	$ 4,685,600	1.0867	$ 5,091,763	0.8515	$ 4,335,760
6		$4,685,600	$ 4,685,600	1.1095	$ 5,198,690	0.8180	$ 4,252,460
7		$4,685,600	$ 4,685,600	1.1328	$ 5,307,862	0.7858	$ 4,170,761
8	$ 2,600,000	$4,055,600	$ 6,655,600	1.1566	$ 7,697,814	0.7548	$ 5,810,484
9		$4,685,600	$ 4,685,600	1.1809	$ 5,533,133	0.7251	$ 4,012,041
10		$4,685,600	$ 4,685,600	1.2057	$ 5,649,329	0.6965	$ 3,934,960
11		$4,685,600	$ 4,685,600	1.2310	$ 5,767,965	0.6691	$ 3,859,360
12		$4,685,600	$ 4,685,600	1.2568	$ 5,889,092	0.6427	$ 3,785,213
13		$4,685,600	$ 4,685,600	1.2832	$ 6,012,763	0.6174	$ 3,712,491
14	$ 2,600,000	$4,055,600	$ 6,655,600	1.3102	$ 8,720,108	0.5931	$ 5,172,046
15		$4,685,600	$ 4,685,600	1.3377	$ 6,267,951	0.5698	$ 3,571,210
16		$4,685,600	$ 4,685,600	1.3658	$ 6,399,578	0.5473	$ 3,502,599
17		$4,685,600	$ 4,685,600	1.3945	$ 6,533,969	0.5258	$ 3,435,306
18		$4,685,600	$ 4,685,600	1.4238	$ 6,671,183	0.5051	$ 3,369,306
19		$4,685,600	$ 4,685,600	1.4537	$ 6,811,277	0.4852	$ 3,304,574
20		$4,685,600	$ 4,685,600	1.4842	$ 6,954,314	0.4661	$ 3,241,085
21	$ 2,600,000	$4,055,600	$ 6,655,600	1.5154	$ 10,085,607	0.4477	$ 4,515,309
22		$4,685,600	$ 4,685,600	1.5472	$ 7,249,462	0.4301	$ 3,117,744
23		$4,685,600	$ 4,685,600	1.5797	$ 7,401,701	0.4131	$ 3,057,845
24		$4,685,600	$ 4,685,600	1.6128	$ 7,557,137	0.3969	$ 2,999,097
25		$4,685,600	$ 4,685,600	1.6467	$ 7,715,837	0.3812	$ 2,941,477
						PV =	$ 126,414,107

BASIS: (Cost basis assumptions are the same as those for two plants except for plant relocation frequency).

1 $37,385,000 Capital Cost of two degassing plant @ $15.9MM & 4 onsite facilities @$2.1MM each

2 $ 2,600,000 Relocation of degassing units at $1.3MM each unit - occurs at years 8,14 and 21

3 $ 4,685,600 Annual operating and maintenance cost for two degassing units
- $630,000 Annual power cost for each unit = 2500kW/hr @ $0.035/kWhr for 300 days/yr
- $1,372,800 Annual cost for 11 operating personnel (8 oper., 2 maint.,1 eng) @ $60/hr
- $ 340,000 Annual maint. Cost = 10% of the equipment cost ($3.4MM)

4 $ 4,055,600 Semi-annual operating and maintenance cost for two degassing units (plant relocation)
- $ 315,000 Annual power cost = 2500kW/hr @ $0.035/kWhr for 300 days/yr
- $1,372,800 Annual cost for 11 operating personnel (8 oper., 2 maint.,1 eng) @ $60/hr
- $ 340,000 Annual maint. Cost = 10% of the equipment cost ($3.4MM)

LIFE CYCLE COST

TITLE: Vapor Pressure Mitigation Plant - Degas 2 (Single Plant)

Single Plant scenario:

PRESENT VALUE = $ 73,721,651
ESCALATION RATE = 2.1%
DISCOUNT RATE = 4.1%

n = YEAR	PROPOSED CAPITAL EXPEND.	PROPOSED MAINT. EXPEND.	PROPOSED TOTAL EXPEND.	ESCALATION FACTOR	ESCALATED COST	DISCOUNT RATE	PRESENT VALUE
1	$ 26,206,000	$ -	$ 26,206,000	1.0000	$ 26,206,000	1.0000	$ 26,206,000
2		$ -	$ -	1.0210	$ -	0.9606	$ -
3		$ 2,342,800	$ 2,342,800	1.0424	$ 2,442,231	0.9228	$ 2,253,644
4		$ 2,342,800	$ 2,342,800	1.0643	$ 2,493,518	0.8864	$ 2,210,346
5	$ 1,300,000	$ 2,027,800	$ 3,327,800	1.0867	$ 3,616,264	0.8515	$ 3,079,337
6		$ 2,342,800	$ 2,342,800	1.1095	$ 2,599,345	0.8180	$ 2,126,230
7		$ 2,342,800	$ 2,342,800	1.1328	$ 2,653,931	0.7858	$ 2,085,380
8		$ 2,342,800	$ 2,342,800	1.1566	$ 2,709,664	0.7548	$ 2,045,315
9		$ 2,342,800	$ 2,342,800	1.1809	$ 2,766,567	0.7251	$ 2,006,020
10	$ 1,300,000	$ 2,027,800	$ 3,327,800	1.2057	$ 4,012,258	0.6965	$ 2,794,682
11		$ 2,342,800	$ 2,342,800	1.2310	$ 2,883,983	0.6691	$ 1,929,680
12	$ 1,300,000	$ 2,027,800	$ 3,327,800	1.2568	$ 4,182,543	0.6427	$ 2,688,329
13		$ 2,342,800	$ 2,342,800	1.2832	$ 3,006,382	0.6174	$ 1,856,245
14	$ 1,300,000	$ 2,027,800	$ 3,327,800	1.3102	$ 4,360,054	0.5931	$ 2,586,023
15		$ 2,342,800	$ 2,342,800	1.3377	$ 3,133,976	0.5698	$ 1,785,605
16		$ 2,342,800	$ 2,342,800	1.3658	$ 3,199,789	0.5473	$ 1,751,299
17		$ 2,342,800	$ 2,342,800	1.3945	$ 3,266,985	0.5258	$ 1,717,653
18	$ 1,300,000	$ 2,027,800	$ 3,327,800	1.4238	$ 4,737,998	0.5051	$ 2,392,943
19		$ 2,342,800	$ 2,342,800	1.4537	$ 3,405,639	0.4852	$ 1,652,287
20		$ 2,342,800	$ 2,342,800	1.4842	$ 3,477,157	0.4661	$ 1,620,543
21	$ 1,300,000	$ 2,027,800	$ 3,327,800	1.5154	$ 5,042,804	0.4477	$ 2,257,654
22		$ 2,342,800	$ 2,342,800	1.5472	$ 3,624,731	0.4301	$ 1,558,872
23		$ 2,342,800	$ 2,342,800	1.5797	$ 3,700,850	0.4131	$ 1,528,923
24		$ 2,342,800	$ 2,342,800	1.6128	$ 3,778,568	0.3969	$ 1,499,548
25	$ 1,300,000	$ 2,027,800	$ 3,327,800	1.6467	$ 5,479,930	0.3812	$ 2,089,092
						PV =	$ 73,721,651

BASIS: (Cost basis assumptions are the same as those for two plants except for plant relocation frequency).

1	$26,206,000	Capital Cost of one degassing plant @ $13.7MM & 2 onsite facilities; $12.5MM ED&I, TVP2000, 1 plant demob/mob and Power Generation.
2	$ 1,300,000	Relocation of degassing unit at $1.3MM each unit - occurs at years 5,10,12,14,18,21,25
3	$ 2,342,800	Annual operating and maintenance cost for one degassing unit
	$630,000	Annual power cost = 2500kW/hr @ $0.035/kWhr for 300 days/yr
	$ 1,372,800	Annual cost for 11 operating personnel (8 oper., 2 maint..1 eng) @ $60/hr
	$ 340,000	Annual maint. Cost = 10% of the equipment cost ($3.4MM)
4	$ 2,027,800	Semi-annual operating and maintenance cost for one degassing unit (plant relocation)
	$ 315,000	Semi-annual power cost = 2500kW/hr @ $0.035/kWhr for 300 days/yr
	$ 1,372,800	Annual cost for 11 operating personnel (8 oper., 2 maint.,1 eng) @ $60/hr
	$ 340,000	Annual maint. Cost = 10% of the equipment cost ($3.4MM)

5. Emissions Projected to be Eliminated From a Full Drawdown in 2025 By Degassing SPR Oil

The projected reductions assume a single full scale drawdown at the end of the SPR life in 2025. Intervening drawdowns, not included in this projection, would result in more product handling and even more emissions over the SPR lifecycle making the below projections somewhat conservative in terms of total estimated lifecycle emissions.

REVISED SPR DRAWDOWN EMISSIONS IN 2025
(WITHOUT DEGAS TREATMENT)

SPR Site	Crude	Max GOR	MMB	Tons VOC [1]	Tons H_2S [1]	Tons Benzene [2]
BC	Sour	1.14	52	1,636	16	5
	Sweet	0.06	24	96	0	0
		BC TOTAL	**76**	**1,732**	**16**	**6**
WH	Sour	0.9	108	2,398	54	8
	Sweet	2.3	114	9,066	1	29
		WH TOTAL	**222**	**11,464**	**55**	
BH	Sour	3.5	98	11,769	106	38
	Sweet	12.0	72	39,086	21	125
		BH TOTAL	**170**	**50,855**	**127**	**163**
BM	Sour	1.6	157	5,811	83	19
	Sweet	3.1	75	7,086	2	23
		BM TOTAL	**232**	**12,897**	**85**	**41**
		SPR TOTAL	**700**	**76,948**	**283**	**210**
			MMB	**Tons VOC**	**Tons H_2S**	**Tons Benzene**
BM Tanks	Sweet	3.1	**22**	**2,078**	**1**	**7**
		BM Tanks	**MMB**	**Tons VOC**	**Tons H_2S**	**Tons Benzene**

1. Based on Lisa Eldredge's calculated factors (tons/MMB) for each SPR site crude oil GOR & composition.
2. Based on Benzene concentration of 0.32% in crude oil (from EPA SPECIATE)

6. ***Example of Public Risk Reduction: Map of Beaumont Port Arthur Area Showing Projected H_2S Emissions From the Distribution of SPR Oil With a Gas Oil Ratio (GOR) of 1.0 (a moderately gassy oil) From the Sunoco and Unocal Terminals. Projections Show Potential Impacts to Surrounding Industry, Residences, and Environmentally Sensitive Areas if uncontrolled by degasification or addition of chemical H_2S scavenger. Degasification Precludes the Need to Use and Handle Highly Toxic (various proprietary alcohol, aldehyde, amine, and aromatic complexes) and Costly H_2S Scavengers to Bind Pollutants.***